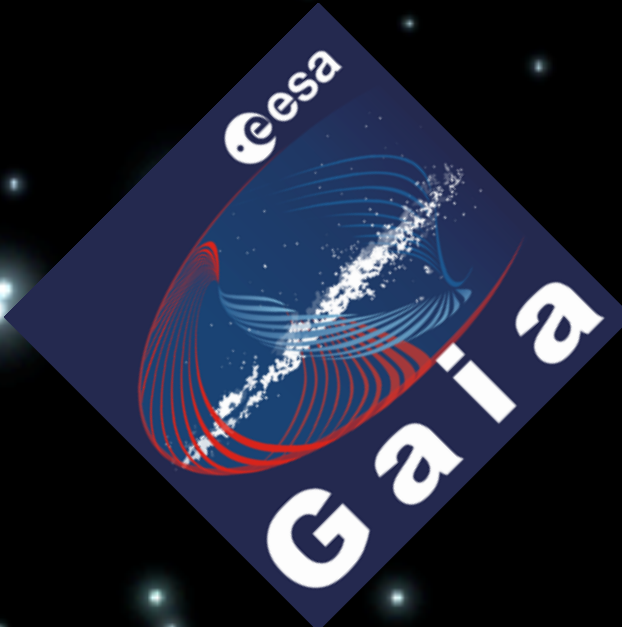




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 Warsaw University Astronomical Observatory, Poland



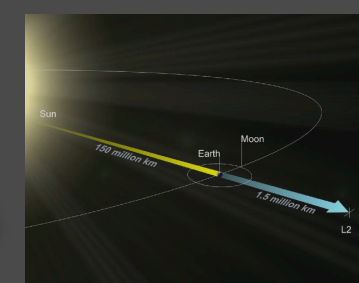
**Simon Hodgkin**  
 Institute of Astronomy, University of Cambridge, UK;



# Around Gaia Alerts in 20 questions

## 1. Where, how, when?

from: ESA/Kourou  
 in: Soyuz-Fregat rocket  
 to: L2 Lagrange point  
 when: June 2013  
 first internal alerts: early 2014  
 first public alerts: mid 2014  
 end of the mission: 2018/2019

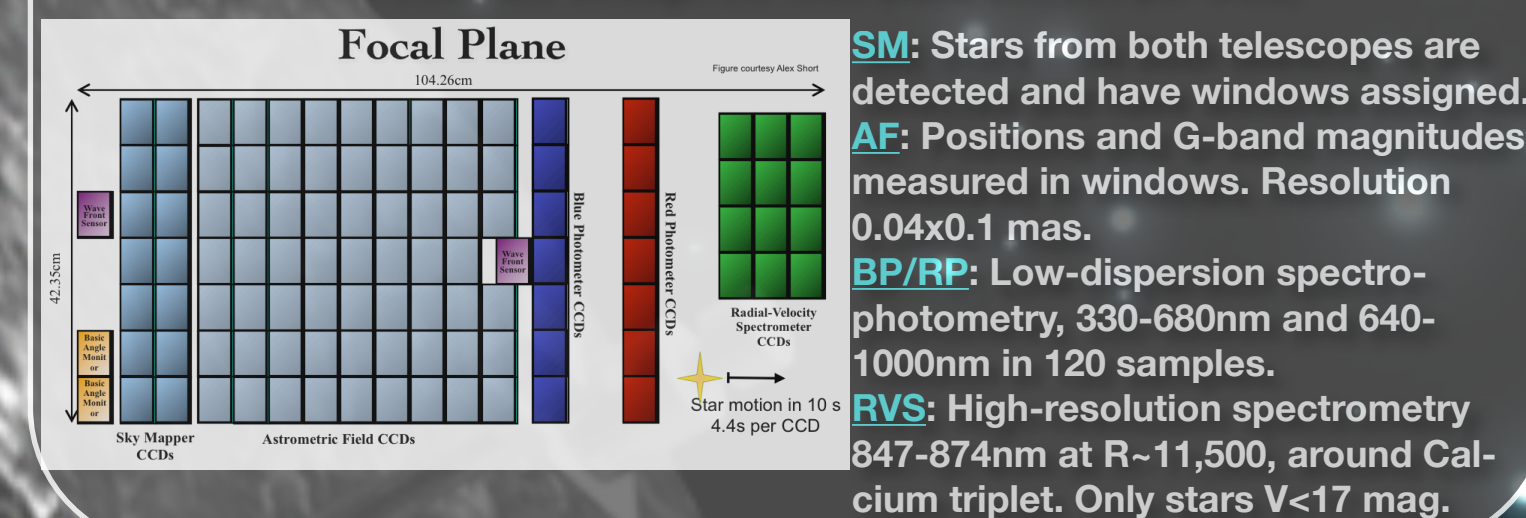


## 2. What telescopes will Gaia have?

Gaia will be equipped with two **1.45x0.5m** telescopes, pointing at 106.5 deg angle from each other.  
 The light from both telescopes will be gathered on a single focal plane.  
 The telescopes will reach to about **V=20 mag**.

## 3. What instruments will Gaia have?

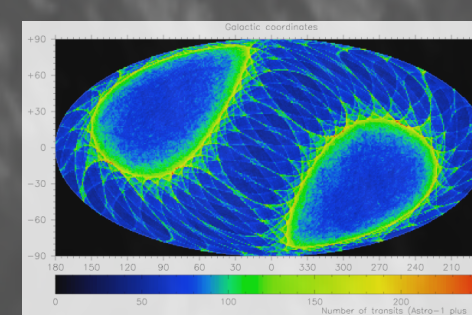
Each object traverses through the focal plane (4.4 sec per CCD)



## 4. What is the data latency?

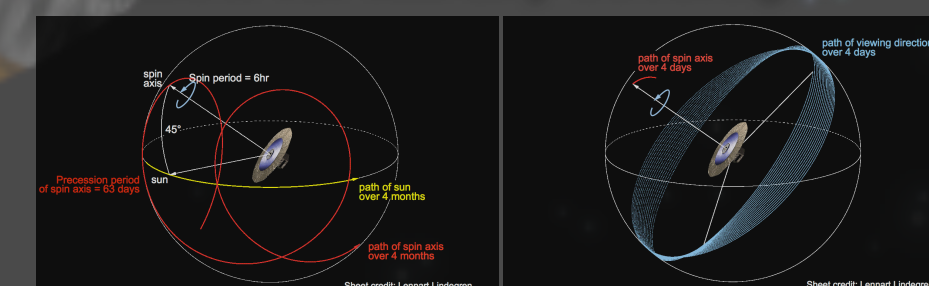
Gaia will be visible from the Earth for only **8h** a day.  
 All data from the last 24h will be downlinked during a contact.  
 Therefore, alerts will be issued between **a couple of hours up to 48 hours** after the observation.

## 5. What is the typical sampling?

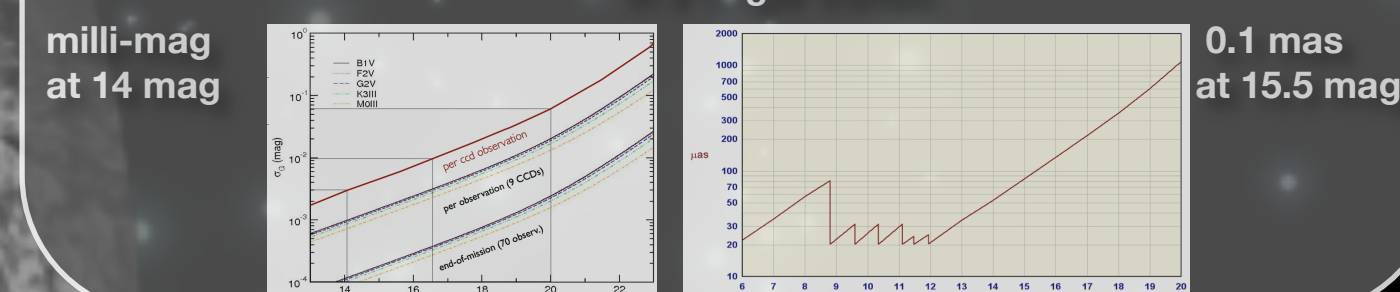


- on average, each object will be observed **80** times
- Galactic bulge and plane less often (~50)
- two observations separated by **~2h**
- next pair usually after ~30 days

## 6. How does the scanning law allow for full sky coverage?



## 7. What is the precision of the instantaneous photometry and astrometry?



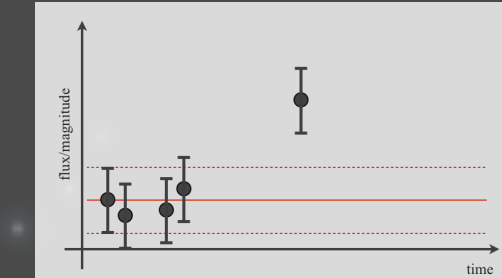
## 8. What is downloaded?

Most of the sky is empty.  
 Gaia will only transmit small windows around stars detected at each transit on the Star Mapper CCDs and associated data.

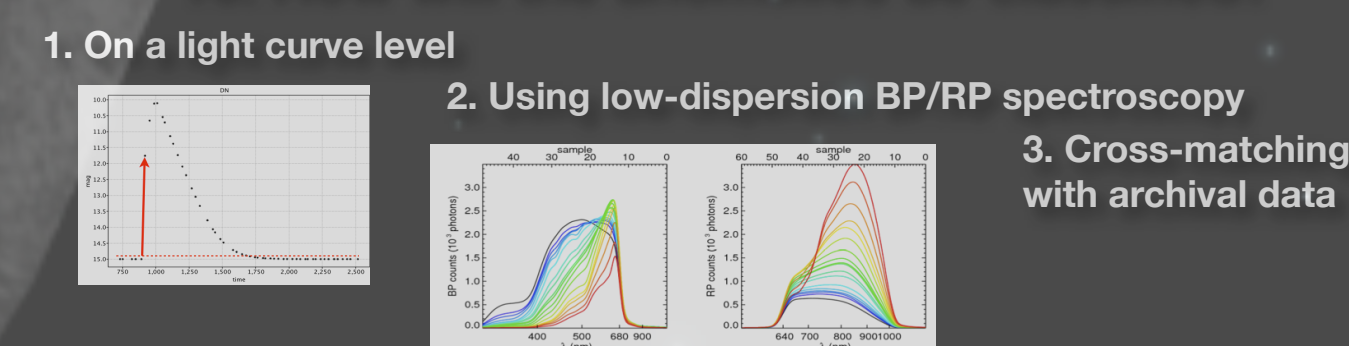


## 9. How will the anomalies be detected?

Simplest possible recipe:  
 1. compare the most recent observation with the historic data available  
 2. inspect for unexpected changes  
 3. no history? - new transient!



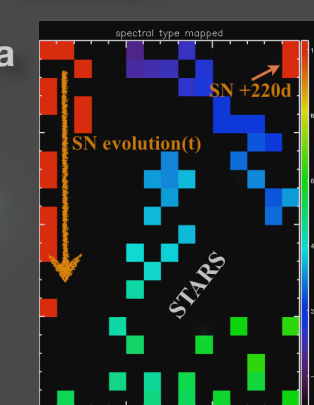
## 10. How will the anomalies be classified?



## 11. How will the BP/RP spectra be used?

With use of the Self-Organizing Maps on low-dispersion spectra available immediately we may be able to:

- confirm a non-stellar nature of the transient
- classify the type of the supernova
- get the "age" of the supernova just from a single observation
- possibly even get the redshift



## 12. How will the alerts be disseminated?

- email
- www server
- Twitter
- iPhone app
- ...?



## 13. What will be in an alert?

- coordinates
- small footprint from SM window around the object
- light curve with all Gaia data available
- low-resolution spectrum at the trigger
- classification result
- cross-matching results

## 14. What are the main triggers of Gaia alerts?

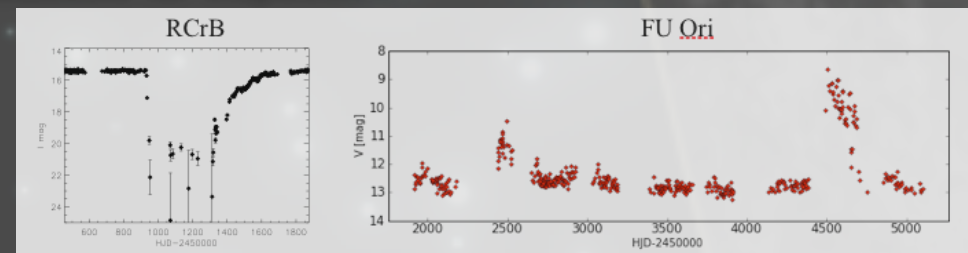
- Supernovae
- Classical novae, dwarf novae
- Gravitational microlensing events
- Be stars
- GRB afterglows
- M-dwarf flares
- R CrB-type stars
- FU Ori-type stars
- Asteroids
- New things?

## 20. How can I get involved now?

- with my telescope time
  - prepare for Gaia Alerts:
  - register at SkyAlert.org
  - set-up your alerts on CRTS stream (SNe, CVs, blazars, etc.)
  - follow-up the alerts
  - contact us with your data!
- with my scientific interests
  - suggest what would be worth detecting and alerting on
  - propose detection algorithms and classification techniques
  - suggest interesting known targets to be observed

## 19. What about known anomalous objects?

Such objects can be added to the **Watch List**. Every time Gaia observes them, their data become available for inspection.



## 18. How many Asteroids will Gaia see?

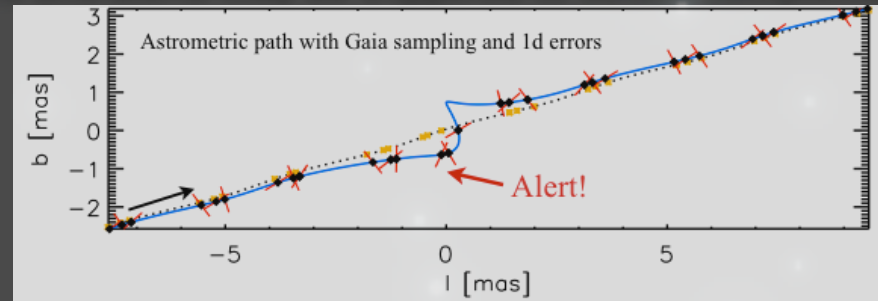
about **250,000** asteroids (mostly known)  
 Alerts on new asteroids and NEO candidates will be based on unsuccessful star matching.

## 17. Will Gaia alert on GRB optical counterparts?

Gaia sampling and data latency is not good for alerting on GRBs.  
 However, we still expect to detect **1-2** bright on-axis afterglows and **5-15** orphan afterglows.

## 16. How many Microlensing Events will Gaia detect?

**1000+** events (mostly long  $t_E > 30d$ ) are expected to be detected photometrically. Mainly in the Galactic bulge and plane.  
 Characteristic **astrometric** centroid motion will be detectable in real-time (larger deviations of about 0.1 mas) in on-going events and alerts may be triggered to obtain complementary photometry.



## 15. How many Supernovae will Gaia detect over 5 years?

**6000** SNe expected down to 19 mag threshold  
 about **2000** will be detected before the maximum



